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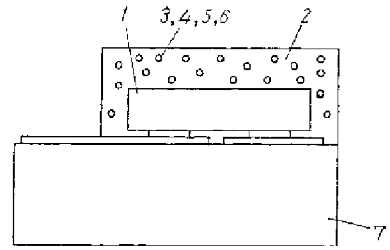
Drawing selection
Representative draw



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FULL CONTENTS CLAIM + DETAILED DESCRIPTION DESCRIPTION OF DRAWINGS DRAWINGS CORRECTION OR AMENDMENT

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FULL CONTENTS

[Claim(s)]
[Claim 1]
The light emitting diode outside Kon purple which emits luminescence which exceeds 350nm and has a luminescence peak to the wavelength field below 410nm, Absorb the near-ultraviolet light which the light emitting diode outside said Kon purple emits, and the phosphor layer containing two or more fluorescent substances from which the fluorescence which has a luminescence peak is visible wavelength emitted [of 380nm or more and 780nm or less] is combined. Luminescence ****** (x, y) in a CIE chromaticity diagram is the semiconductor light emitting element which emits the white system light in the range of 0.21<=x<=0.48 and 0.19<=y<=0.45,
The blue system fluorescent substance from which said phosphor layer emits [wavelength] the fluorescence of a blue system which has a luminescence peak below 400nm or more and 500nm, The green system fluorescent substance from which the fluorescence of a green system which has a luminescence peak is wavelength emitted below 500nm or more and 550nm, The semiconductor light emitting element characterized by including the red system fluorescent substance from which the fluorescence of a red system which has a luminescence peak is wavelength emitted below 600nm or more and 660nm, and the yellow system fluorescent substance from which the fluorescence of a yellow system which has a luminescence peak is wavelength emitted below 550nm or more and 600nm.
[Claim 2]
The semiconductor light emitting element according to claim 1 characterized by said yellow system fluorescent substance being a silicate fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(Sr1-a1-b1-xBaa1Cab1Eux)2SiO4
However, a1, b1, and x are numerical values with which it is satisfied of 0<=a1<=0.3, 0<=b1<=0.8, and 0< x<1 respectively.
[Claim 3]
The semiconductor light emitting element according to claim 2 characterized by being the silicate fluorescent substance with which said silicate fluorescent substance makes a subject the compound which has the crystal structure of ****** and is expressed with the following chemical formula.
(Sr1-a1-b2-xBaa1Cab2Eux)2SiO4
However, a1, b2, and x are numerical values with which it is satisfied of 0<=a1<=0.3, 0<=b2<=0.6, and 0< x<1 respectively.
[Claim 4]
said blue system -- (1) of the following [fluorescent substance], or the blue system of (2) -- it is a fluorescent substance -- said green system -- (3) of the following [fluorescent substance], or the green system of (4) -- Claim 1 characterized by being a fluorescent substance and said red system fluorescent substance being the following red system fluorescent substance of (5) - a semiconductor light emitting

element given in any 1 clause of three.
(1) The HARO orthophosphate fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M11-xEux)10(PO4)6Cl2
However, at least one alkaline-earth-metals element with which M1 is chosen from the group of Ba, Sr, and Ca and Mg, and x are numerical values with which it is satisfied of 0< x<1.
(2) The Al Min acid chloride fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M21-xEux)(M31-y1Mny1)Al10O17
However, at least one element with which at least one alkaline-earth-metals element with which M2 is chosen from the group of Ba, Sr, and Ca, and M3 are chosen from the group of Mg and Zn, x, and y1 are numerical values with which it is satisfied of 0< x<1 and 0 <=y1<0.05 respectively.
(3) The Al Min acid chloride fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M21-xEux)(M31-y2Mny2)Al10O17
However, at least one element with which at least one alkaline-earth-metals element with which M2 is chosen from the group of Ba, Sr, and Ca, and M3 are chosen from the group of Mg and Zn, x, and y2 are numerical values with which it is satisfied of 0< x<1 and 0.05 <=y2<1 respectively.
(4) The silicate fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M11-xEux)2SiO4
However, at least one alkaline-earth-metals element with which M1 is chosen from the group of Ba, Sr, and Ca and Mg, and x are numerical values with which it is satisfied of 0< x<1.
(5) The acid sulfide fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(Ln1-xEux)O2S
However, at least one rare earth element as which Ln is chosen from the group of Sc, Y, La, and Gd, and x are numerical values with which it is satisfied of 0< x<1.
[Claim 5]
Claim 1 characterized by being the light emitting diode outside Kon purple in which the light emitting diode outside said Kon purple has the luminous layer constituted from a gallium nitride system compound semiconductor - a semiconductor light emitting element given in any 1 clause of four.
[Claim 6]
The semiconductor light emitting element according to claim 5 characterized by the general color rendering indices (Ra) of the white system light emitted from a light emitting element being 70 or more and less than 100.
[Claim 7]
Semiconductor luminescence equipment characterized by constituting using the semiconductor light emitting element of a description in Claim 1 - any 1 clause of six.
[Claim 8]
The light emitting diode outside Kon purple which emits luminescence which exceeds 350nm and has a luminescence peak to the wavelength field below 410nm, Absorb the near-ultraviolet light which the light emitting diode outside said Kon purple emits, and the phosphor layer containing two or more fluorescent substances from which the fluorescence which has a luminescence peak is visible wavelength emitted [of 380nm or more and 780nm or less] is combined. Luminescence ****** (x, y) in a CIE chromaticity diagram is semiconductor luminescence equipment emit 0.21<=x<=0.48 and the white system light in the range of 0.19<=y<=0.45,
The blue system fluorescent substance from which said phosphor layer emits [wavelength] the fluorescence of a blue system which has a luminescence peak below 400nm or more and 500nm, The green system fluorescent substance from which the fluorescence of a green system which has a luminescence peak is wavelength emitted below 500nm or more and 550nm, Semiconductor luminescence equipment characterized by including the red system fluorescent substance from which the fluorescence of a red system which has a luminescence peak is wavelength emitted below 600nm or more and 660nm, and the yellow system fluorescent substance from which the fluorescence of a yellow system which has a luminescence peak is wavelength emitted below 550nm or more and 600nm.

 [Detailed Description of the Invention]
Technical field
This invention relates to the semiconductor light emitting element and luminescence equipment emit white system light combining the light emitting diode outside **** (it is henceforth described as the outside LED of ****), and two or more fluorescent substances.

Background art
The outside LED of Kon [who exceeds 350nm and has a luminescence peak from the former to the wavelength field besides 410nm or less Kon being purple] purple (strictly LED chip outside ****) The near-ultraviolet light which the outside LED of this **** emits is absorbed, and the semiconductor light emitting element which emits the white system light which combines the phosphor layer containing two or more inorganic fluorescent substances emit the fluorescence which has a luminescence peak in visible wavelength within the limits of 380nm or more and 780nm or less is known. Since the semiconductor light emitting element which uses an organic fluorescent substance is excelled in a durable field, said semiconductor light emitting element using an inorganic fluorescent substance is used widely.
In addition, on these Descriptions, luminescence ****** (x, y) in a CIE chromaticity diagram defines 0.21<=x<=0.48 and the light which is within the limits of 0.19<=y<=0.45 as white system light.
As such a semiconductor light emitting element, the semiconductor light emitting element indicated by JP, H11-246857,A, JP,2000-183408,A, JP,2000-509912,A, or JP,2001-143869,A is known, for example.
In JP,H11-246857,A, general formula (La1-x-yEuxSmy) 2O2S The acid sulfuration lantern fluorescent substance expressed with (0.01<=x<=0.15, 0.0001<=y<=0.03) is used as a red fluorescent substance. [however,] It has the luminous layer constituted from a gallium nitride system compound semiconductor, and the semiconductor light emitting element which emits light with a wavelength of around 370nm and which is combined the outside LED of Kon purple is indicated. Moreover, in JP,H11-246857,A, the technology about the semiconductor light emitting element which emits the white light which has arbitrary color temperature is indicated by combining said red fluorescent substance, and other blue and a green fluorescent substance proper.
The LED chip outside purple which emits the purple outdoor daylight which has the luminous layer constituted from a gallium nitride system compound semiconductor, and has a luminescence peak near 370nm, The semiconductor light emitting element possessing the 1st phosphor layer containing the blue fluorescent substance which absorbs said purple outdoor daylight and emits light in blue light, and the 2nd phosphor layer containing the yellow-orange color fluorescent substance which absorbs said blue light and emits light in yellow-orange colored light is indicated. Moreover, the blue fluorescent substance which consists of at least one sort chosen from the following (1) - (3) as a blue fluorescent substance is used.
(1) The divalent europium activation HARO orthophosphate fluorescent substance substantially expressed with general formula (M1, Eu) 10(PO4) 6Cl2 (M1 expresses among a formula at least one element chosen from the group of Mg, Ca, Sr, and Ba).
(2) general formula a(M2, Eu) O-bAl 2O3 (the inside of a formula, and M2 -- Mg --) the numerical value with which at least one element chosen from the group of Ca, Sr, Ba, Zn, Li, Rb, and Cs is shown, and a and b are satisfied of a> 0, b> 0, and 0.2 <=a/b<=1.5 -- it is -- the divalent europium activation Al Min acid chloride fluorescent substance expressed substantially.
(3) General formula a(M2, Euv, Mnw) O-bAl 2O3 (among a formula) M2 shows at least one element chosen from the group of Mg, Ca, Sr, Ba, Zn, Li, Rb, and Cs. the numerical value with which a, b, v, and w are satisfied of a> 0, b> 0, 0.2<=a/b<=1.5, and 0.001 <=w/v<=0.6 -- it is -- the divalent europium expressed substantially and a manganese activation Al Min acid chloride fluorescent substance.
Moreover, as a yellow-orange color fluorescent substance, it is general formula (Y1-x-yGdxCey) 3aluminum5O12 (among a formula). the numerical value with which x and y are satisfied of 0.1<=x<=0.55 and 0.01<=y<=0.4 -- it is -- the trivalent cerium activation Al Min acid chloride fluorescent substance (it is henceforth called a YAG system fluorescent substance) expressed substantially is used.
moreover, [JP,2000-509912,A] The outside LED of the purple which has a luminescence peak to a wavelength field (300nm or more and 370nm or less) The blue fluorescent substance which has a luminescence peak to a wavelength field (430nm or more and 490nm or less), The semiconductor light emitting element which combines the green fluorescent substance which has a luminescence peak to a wavelength field (520nm or more and 570nm or less), and the red fluorescent substance which has a luminescence peak to a wavelength field (590nm or more and 630nm or less) is indicated. In this semiconductor light emitting element, as a blue fluorescent substance BaMgAl10O17:Eu, Sr5(PO4) 3 Cl: Eu, and ZnS:Ag (the luminescence peak wavelength of all is 450nm) as a green fluorescent substance ZnS: Cu (luminescence peak wavelength of 550nm), BaMgAl10O17:Eu, and Mn (luminescence peak wavelength of 515nm) as a red fluorescent substance Y2O2S:Eu3+ (luminescence peak wavelength of 628nm), YVO4:Eu3+ (luminescence peak wavelength of 620nm), Y(V, P, B) O4: Eu3+ (luminescence peak wavelength of 615nm), YNbO4:Eu3+ (luminescence peak wavelength of 615nm), the YTaO4:Eu3+ luminescence peak wavelength of 615nm, and [Eu(acac)3 (phen)] (luminescence peak wavelength of 611nm) are used.
The organicity LED which makes organic material JP,2001-143869,A with a luminous layer, and has a luminescence peak on the other hand in the wavelength range besides purple-blue of 430nm or less - **** Or the charge of non-equipments is made into a luminous layer, and the semiconductor light emitting element which combines the inorganic matter LED which has a luminescence peak in the wavelength

range besides said purple-blue - ****, a blue fluorescent substance, a green fluorescent substance, and a red fluorescent substance is indicated. In this semiconductor light emitting element, as a blue fluorescent substance Sr2P2O7:Sn4+, Sr4aluminum14O25:Eu2+, BaMgAl10O17:Eu2+, SrGa2S4:Ce3+, CaGa2S4: Ce3+, aluminum(Mg (Ba, Sr), Mn) 10O17:Eu2+, 10(PO4) 6Cl2:Eu2+, BaAl2SiO8:Eu2+, (Sr, Ca, Ba, Mg) Sr2P2O7:Eu2+, Sr5(PO4) 3Cl:Eu2+, 5(Sr, Ca, Ba) (PO4) 3Cl:Eu2+, BaMg2aluminum16O27:Eu2+, 5(Ba, Ca) (PO4) 3Cl:Eu2+, They are used by Ba3MgSi2O8:Eu2+ and Sr3MgSi2O8:Eu2+, and as a green fluorescent substance aluminum16O27:Eu2+, Mn2+, Sr4aluminum14O25:Eu2+, (BaMg) aluminum2Si2O8:Eu2+, 2(BaMg) SiO4:Eu2+, (SrBa) Y2SiO5:Ce3+, Tb3+, Sr2P2O7-Sr2 B-2O7:Eu2+, 5 (BaCaMg) (PO4) 3Cl:Eu2+, and Sr2Si3O8-2SrCl2:Eu2+ and Zr2SiO4-MgAl11O19:Ce3+, Tb3+, They are used by Ba2SiO4:Eu2+, Sr2SiO4:Eu2+, and SiO(BaSr)4:Eu2+, and as a red fluorescent substance Y2O2S:Eu3+, YAlO3:Eu3+, Ca2Y2(SiO4) 6:Eu3+, LiY9(SiO4) 6O2:Eu3+, YVO4:Eu3+, CaS:Eu2+, Gd2O3:Eu3+, Gd2O2S:Eu3+, and Y(P, V) O4:Eu3+ are used.
thus, the conventional white system -- the semiconductor light emitting element which emits light -- a blue system -- a fluorescent substance and a green system -- the mixed colors of luminescence which a fluorescent substance and a red system fluorescent substance emit, or a blue system -- the mixed colors of luminescence which a fluorescent substance and a yellow system fluorescent substance emit -- a white system -- light is obtained.
In addition, in the conventional semiconductor light emitting element of the method which obtains white system light by the mixed colors of luminescence which a blue system fluorescent substance and a yellow system fluorescent substance emit, said YAG system fluorescent substance is used as a yellow system fluorescent substance. Said YAG system fluorescent substance exceeds 350nm, and it Moreover, and a wavelength field of 400nm or less, Light is hardly emitted by excitation of a near-ultraviolet light (360nm or more and 400nm or less) which has the luminous layer constituted especially from a gallium nitride system compound semiconductor and which the outside LED of Kon purple releases. a blue system (400nm or more and 530nm or less) -- the conventional semiconductor light emitting element which used the YAG system fluorescent substance since it was the fluorescent substance it is efficient and emit yellow light under excitation of light -- a blue system -- making a fluorescent substance indispensable -- said blue system -- exciting a yellow system fluorescent substance by the blue light which a fluorescent substance emits -- a white system -- light has been obtained.
The semiconductor light emitting element which emits such a white system light is known as a semiconductor light emitting element with much demand as objects for luminescence equipment, such as a lighting installation and a display device.
The semiconductor luminescence equipment which, on the other hand, combined inorganic compound fluorescent substances other than a YAG system fluorescent substance with LED is also conventionally well-known. In JP,2001-143869,A mentioned above, the semiconductor light emitting element which used Ba2SiO4:Eu2+, Sr2SiO4:Eu2+, Mg2SiO4:Eu2+, 2(BaSr) SiO4:Eu2+, and a 2(BaMg) SiO4:Eu2+ silicate fluorescent substance is indicated.
However, in a semiconductor light emitting element given in this JP,2001-143869,A, any silicate fluorescent substance is application as a green system fluorescent substance, and is not application as a yellow system fluorescent substance. Moreover, it is carried out even if it is more desirable from a point of luminous efficiency to use Organicity LED than from the inorganic matter LED which consists of an inorganic compound. Namely, invention given in this open gazette is not a thing about the semiconductor light emitting element which combines each fluorescent substance of a blue system, green system, and yellow system and a red system the outside LED of ****. It is related with the outside LED of ****, and the semiconductor light emitting element which combines the fluorescent substance of three kinds of inorganic compounds of an Organicity LED, blue system, green system, and red system preferably.
[in addition, the Sr2SiO4:Eu2+ silicate fluorescent substance indicated to this JP,2001-143869,A as long as it is an experiment of this invention persons] [the amount of Eu2+ luminescence center addition (= several/(several / of Sr atom / number of +Eu atoms):x of Eu atom) which is the fluorescent substance which can have two ****** (****** and single ****), and is used practical at least] Within the limits of 0.01<=x<=0.05, it is ******Sr2SiO4:Eu2+ ([alpha'-Sr2SiO4:Eu2+]). It is the yellow system fluorescent substance from which the yellow light which has a luminescence peak is emitted near the wavelength of 560-575nm, and single **** Sr2SiO4:Eu2+ (beta-Sr2SiO4:Eu2+) is a green system fluorescent substance from which the green light which has a luminescence peak is emitted near the wavelength of 545nm. Therefore, it can be considered that a Sr2SiO4:Eu2+ green fluorescent substance given in JP,2001-143869, A is a single **** Sr2SiO4:Eu2+ fluorescent substance.
Here, explanation of said silicate fluorescent substance knows from the former the silicate fluorescent substance (however, numerical value with which a3, b3, and x are satisfied of 0<=a3<=1, 0<=b3<=1, and 0< x<1 respectively) expressed with the chemical formula of 2(Sr1-a3-b3-xBaa3Cab3Eux) SiO4. Said silicate fluorescent substance is a fluorescent substance with which examination was made as a fluorescent substance for fluorescence lamps, and it is known by changing composition of Ba-Sr-Ca that it is the fluorescent substance which changes by within the limits whose peak wavelengths of luminescence

are 505nm or more and about 598nm or less. Furthermore, it is also known that it is the fluorescent substance in which comparatively efficient luminescence is shown under the optical irradiation within the limits of 170-350nm (J. Electrochemical Soc.Vol.115, No.11(1968) pp.1181 -1184 reference).
However, there is no description about said silicate fluorescent substance showing efficient luminescence under the near-ultraviolet light excitation condition of the long wavelength field over 350nm in said literature. Said silicate fluorescent substance exceeds said 350nm, and it For this reason, and the wavelength field besides 410nm or less Kon being purple, It was not known by the near-ultraviolet light excitation near [which the outside LED of Kon purple releases] 370-390nm which has the luminous layer especially constituted from a gallium nitride system compound semiconductor until now that it is the fluorescent substance emit efficient yellow system luminescence below 550nm or more and 600nm.
If it is in the conventional semiconductor light emitting element and the luminescence equipment which combine the phosphor layer which contains two or more fluorescent substances the outside LED of **** a blue system -- a fluorescent substance and a green system -- the mixed colors of luminescence which a fluorescent substance and a red system fluorescent substance emit, or a blue system -- the mixed colors of luminescence which a fluorescent substance and a yellow system fluorescent substance emit -- a white system -- a semiconductor light emitting element and luminescence equipment consisted of methods which obtain light.
In addition, on these Descriptions, various display devices (for example, a LED information display terminal, LED traffic lights, a LED stop lamp, a LED directional light of a car, etc.) and various lighting installations (the lighting outside LED indoor, in-the-car LED light, a LED emergency light, the source of LED side luminescence, etc.) are widely defined as luminescence equipment.
By the way, if it was in the conventional white system semiconductor light emitting element and white system semiconductor luminescence equipment which combined the phosphor layer which contains two or more fluorescent substances the outside LED of ****, the light flux of the white system light which a semiconductor light emitting element and semiconductor luminescence equipment emit was low. This exceeds 350nm and and under near-ultraviolet light excitation of 410nm or less Since [that development of the fluorescent substance in which high luminous efficiency is shown is enough until now] it is not carried out There are few kinds of fluorescent substance which can be used in blue system fluorescent substances, green system fluorescent substances, and all the red system fluorescent substances as a white system semiconductor light emitting element and an object for luminescence equipment. Each fluorescent substance of a blue system, green system, and red system in which comparatively high luminous efficiency is shown is not only limited to a small number, but it originates in the form of the emission spectrum of white system light being limited. Moreover, it originates also in having obtained white system light by the mixed colors of the light which three kinds of fluorescent substances of a blue system, green system, and red system emit, or the mixed colors of the light which two kinds of fluorescent substances, a blue system and a yellow system, emit.
the mixed colors of the light which three kinds of fluorescent substances of a blue system, green system, and red system emit -- the Takamitsu bunch -- a white system with the high (Ra = 70 or more) number Ra of average color renderings -- in order to obtain light a blue system -- a fluorescent substance and a green system -- if all the fluorescent substances of a fluorescent substance and a red system fluorescent substance must be efficient and there is at least one fluorescent substance of low luminous efficiency in these fluorescent substances -- a white system -- the relation of the color balance of light -- a white system -- the light flux of light becomes low.
The indication of invention
This invention is made in order to solve these problems, and it aims at offering the semiconductor light emitting element and semiconductor luminescence equipment emit the Takamitsu bunch and the white system light of high Ra which combine the phosphor layer which contains two or more fluorescent substances the outside LED of ****.
[the semiconductor light emitting element concerning this invention] in order to solve said technical problem The light emitting diode outside Kon purple which emits luminescence which exceeds 350nm and has a luminescence peak to a wavelength field of 410nm or less, Absorb the near-ultraviolet light which the light emitting diode outside said Kon purple emits, and the phosphor layer containing two or more fluorescent substances from which the fluorescence which has a luminescence peak is visible wavelength emitted [of 380nm or more and 780nm or less] is combined. Luminescence ****** (x, y) in a CIE chromaticity diagram is the semiconductor light emitting element which emits 0.21<=x<=0.48 and the white system light in the range of 0.19<=y<=0.45. The blue system fluorescent substance from which said phosphor layer emits [wavelength] the fluorescence of a blue system which has a luminescence peak below 400nm or more and 500nm, The green system fluorescent substance from which the fluorescence of a green system which has a luminescence peak is wavelength emitted below 500nm or more and 550nm, It is characterized by including the red system fluorescent substance from which the fluorescence of a red system which has a luminescence peak is wavelength emitted below 600nm or more and 660nm, and the yellow system fluorescent substance from which the fluorescence of a yellow system

which has a luminescence peak is wavelength emitted below 550nm or more and 600nm.
[especially if the said Kon purple outside LED is LED which emits / including the outside LED of purple / of 250nm or more and 410nm or less / wavelength / luminescence which has a luminescence peak, it will not be limited here, but] The outside LED of Kon purple [desirable purple LED emits / of 300nm or more and 410nm or less / wavelength / luminescence which has a luminescence peak from viewpoints, such as ease of acquisition, ease of manufacture, cost, and luminescence intensity,] It is outside [LED] Kon [who emits luminescence the Kon purple outside LED which exceeds 350nm much more preferably, and has a luminescence peak to the wavelength field below 400nm which emits luminescence which exceeds 350nm and has a luminescence peak to a wavelength field of 410nm or less more preferably] purple.
When the above phosphor layers are used as a phosphor layer, a semiconductor light emitting element Blue system luminescence below 400nm or more and 500nm, It comes to emit luminescence which has four kinds of light colors of green system luminescence below 500nm or more and 550nm, red system luminescence below 600nm or more and 660nm, and yellow system luminescence below 550nm or more and 600nm, and comes to emit white system light by the mixed colors of four kinds of this light color. Moreover, since comparatively high yellow system luminescence of spectral luminous efficacy compensates color purity with a part for the light flux fall of the white system light by red system luminescence with low spectral luminous efficacy of a good thing, the light flux of white system light becomes high. Moreover, since the spectral distribution of the white system light obtained becomes the thing excellent in the field of color balance, the number Ra of average color renderings becomes high.
In the semiconductor light emitting element concerning this invention, a yellow system fluorescent substance has the desirable silicate fluorescent substance which makes a subject the compound expressed with the following chemical formula.
$(Sr_{1-a1-b1-x}Ba_{a1}Ca_{b1}Eu_x)_2SiO_4$
However, a1, b1, and x are numerical values with which it is satisfied of $0<=a1<=0.3$, $0<=b1<=0.8$, and $0< x<1$ respectively.
[here / the numerical value of a1 in said chemical formula, b1, and x] From the stability of the crystal to the heat of a fluorescent substance, the temperature quenching-proof characteristic, the luminescence intensity of yellow system luminescence, and a viewpoint of a light color preferably It is desirable that they are $0<a1<=0.2$, $0<=b1<=0.7$, $0.005<=x<=0.1$, and the numerical value with which it is satisfied of $0<a1<=0.15$, $0<=b1<=0.6$, and $0.01<=x<=0.05$ respectively still more preferably respectively.
In addition, [said silicate fluorescent substance] as an example of an excitation spectrum and an emission spectrum is shown in drawing 4 It is the yellow system fluorescent substance from which it has an excitation peak near 250-300nm, the light of large wavelength within the limits of 100-500nm is absorbed, and the fluorescence of a yellow system which has a luminescence peak is wavelength emitted [550-600nm yellowish green - yellow - / of **]. therefore, the blue system from which said silicate fluorescent substance changes a near-ultraviolet light into blue light like a YAG system fluorescent substance -- there is no fluorescent substance -- ** -- since comparatively efficient yellow system luminescence will be emitted when the near-ultraviolet light which the outside LED of **** emits is irradiated, it will become desirable in respect of luminous efficiency.
In addition, each of said a1 and b1 becomes the silicate fluorescent substance with which ****** and single **** were intermingled when close to 0 easily, in being larger than said numerical range, a crystal field becomes weak, and it becomes the fluorescent substance which is tinged with greenishness in any case, and yellow color purity becomes bad luminescence. Moreover, in x, in being smaller than said numerical range, since Eu^{2+} luminescence center concentration is low, the luminescence intensity of a silicate fluorescent substance becomes weak, and in being large, the problem of temperature quenching that luminescence intensity falls with the rise of the ambient air temperature of a silicate fluorescent substance becomes remarkable.
In the semiconductor light emitting element concerning this invention, making into a subject the compound expressed with the following chemical formula has [a silicate fluorescent substance] desirable things.
$(Sr_{1-a1-b2-x}Ba_{a1}Ca_{b2}Eu_x)_2SiO_4$
However, respectively, a1, b2, and x are numerical values with which it is satisfied of $0<=a1<=0.3$, $0<=b2<=0.6$, and $0< x<1$, and from the same viewpoint as the above-mentioned case preferably It is desirable that they are $0<a1<=0.2$, $0<=b2<=0.4$, $0.005<=x<=0.1$, and the numerical value with which it is satisfied of $0<a1<=0.15$, $0<=b2<=0.3$, and $0.01<=x<=0.05$ respectively more preferably respectively.
in the semiconductor light emitting element concerning this invention -- a blue system -- (1) of the following [fluorescent substance], or the blue system of (2) -- it is a fluorescent substance -- a green system -- (3) of the following [fluorescent substance], or the green system of (4) -- it is a fluorescent substance and, as for a red system fluorescent substance, it is desirable that it is the following red system fluorescent substance of (5).
(1) The HARO orthophosphate fluorescent substance which makes a subject the compound expressed

with the following chemical formulae.
(M11-xEux)10(PO4)6Cl2
However, at least one alkaline-earth-metals element with which M1 is chosen from the group of Ba, Sr, and Ca and Mg, and x are numerical values with which it is satisfied of 0< x<1.
(2) The Al Min acid chloride fluorescent substance which makes a subject the compound expressed with the following chemical formulae.
(M21-xEux)(M31-y1Mny1)Al10O17
However, at least one element with which at least one alkaline-earth-metals element with which M2 is chosen from the group of Ba, Sr, and Ca, and M3 are chosen from the group of Mg and Zn, x, and y1 are numerical values with which it is satisfied of 0< x<1 and 0 <=y1<0.05 respectively.
(3) The Al Min acid chloride fluorescent substance which makes a subject the compound expressed with the following chemical formulae.
(M21-xEux)(M31-y2Mny2)Al10O17
[at least one alkaline-earth-metals element with which M2 is chosen from the group of Ba, Sr, and Ca and M3] [however,] At least one element with which at least one element chosen from the group of Mg and Zn and M3 are chosen from the group of Mg and Zn, x, and y2 are numerical values with which it is satisfied of 0< x<1 and 0.05 <=y2<1 respectively.
(4) The silicate fluorescent substance which makes a subject the compound expressed with the following chemical formulae.
(M11-xEux)2SiO4
However, at least one alkaline-earth-metals element with which M1 is chosen from the group of Ba, Sr, and Ca and Mg, and x are numerical values with which it is satisfied of 0< x<1.
(5) The acid sulfide fluorescent substance which makes a subject the compound expressed with the following chemical formulae.
(Ln1-xEux)O2S
However, at least one rare earth element as which Ln is chosen from the group of Sc, Y, La, and Gd, and x are numerical values with which it is satisfied of 0< x<1.
Since each of aforementioned blue system fluorescent substances, green system fluorescent substances, and red system fluorescent substances is efficient fluorescent substances emit a strong light by excitation of a near-ultraviolet light, if it is made the combination of such a fluorescent substance, said phosphor layer will come to emit white system light with big luminescence intensity.
As for the **** outside LED, in the semiconductor light emitting element concerning this invention, it is desirable that it is outside [LED] Kon [who has the luminous layer constituted from a gallium nitride system compound semiconductor] purple.
By the Kon [who has the luminous layer constituted from a gallium nitride system compound semiconductor] purple outside's LED showing high luminous efficiency, and using the outside LED of such ****, since long-term continuation operation is also possible, long-term continuation operation is possible and, moreover, the semiconductor light emitting element which emits the white system light of the Takamitsu bunch is obtained.
In the semiconductor light emitting element concerning this invention, it is desirable that the numbers Ra of average color renderings of the white system light emitted from a light emitting element are 70 or more and less than 100.
If this number Ra of average color renderings is good 80 or more and to carry out to 88 or more and less than 100 much more preferably less than 100 and they make it more desirable in this way, it will become the semiconductor light emitting element which was especially suitable for the lighting installation.
The 1st semiconductor luminescence equipment concerning this invention is semiconductor luminescence equipment constituted using one of the above-mentioned semiconductor light emitting elements.
Since the above-mentioned semiconductor light emitting element emits the Takamitsu bunch and the white system light of high Ra, if it constitutes luminescence equipment using the semiconductor light emitting element concerning this invention, the semiconductor luminescence equipment emit the Takamitsu bunch and the white system light of high Ra will be obtained.
[moreover, the 2nd semiconductor luminescence equipment concerning this invention] The light emitting element outside Kon purple which emits luminescence which exceeds 350nm and has a luminescence peak to the wavelength field below 410nm, Absorb the near-ultraviolet light which the light emitting element outside said Kon purple emits, and the phosphor layer containing two or more fluorescent substances from which the fluorescence which has a luminescence peak is visible wavelength emitted [of 380nm or more and 780nm or less] is combined. It is semiconductor luminescence equipment luminescence ****** (x, y) in a CIE chromaticity diagram emits 0.21<=x<=0.48 and the white system light in the range of 0.19<=y<=0.45. The blue system fluorescent substance from which said phosphor layer emits [wavelength] the fluorescence of a blue system which has a luminescence peak below 400nm or more and 500nm, The green system fluorescent substance from which the fluorescence of a green system which has a luminescence peak is wavelength emitted below 500nm or more and

550nm, It is characterized by including the red system fluorescent substance from which the fluorescence of a red system which has a luminescence peak is wavelength emitted below 600nm or more and 660nm, and the yellow system fluorescent substance from which the fluorescence of a yellow system which has a luminescence peak is wavelength emitted below 550nm or more and 600nm.
Even if it does in this way, the semiconductor luminescence equipment emit the Takamitsu bunch and the white system light of high Ra is obtained.
Here, as an example of semiconductor luminescence equipment, various lighting installations, such as various display devices, such as a LED information display terminal, LED traffic lights, a LED stop lamp of a car, and a LED directional light, and a lighting outside LED indoor, in-the-car LED light, a LED emergency light, a source of LED side luminescence, can be mentioned.
In addition, even if it uses the light emitting element (not limited to a semiconductor light emitting element) which emits luminescence in this invention which replaces with out of [LED] Kon purple, and has a luminescence peak to the same wavelength field as a main luminescence ingredient, it cannot be overemphasized that the same operation effect is acquired and the same white system light emitting element is obtained.
As such a light emitting element, there are a laser diode, a field luminescence laser diode, an inorganic electroluminescence element, an organic electroluminescence element, etc.
The best form for inventing
[The form 1 of operation]
The form of operation of the semiconductor light emitting element of this invention is hereafter explained using Drawings. Drawing 1 - drawing 3 are the longitudinal sections of the semiconductor light emitting element from which form differs, respectively.
As a typical example of a semiconductor light emitting element, the semiconductor light emitting element shown in drawing 1 , drawing 2 , or drawing 3 is mentioned. [drawing 1] while drawing 1 carries out flow loading of the flip chip type LED1 outside Kon purple on the submount element 7 The package of the resin which is inherent in the fluorescent substance particles (it is henceforth called BGRY fluorescent substance particles) containing the blue system fluorescent substance particles 3, the green system fluorescent substance particles 4, the red system fluorescent substance particles 5, and the yellow system fluorescent substance particles 6, and serves as a phosphor layer shows the semiconductor light emitting element of the structure which closed LED1 outside ****. [drawing 2 / the cup 9 prepared in the mount lead of the lead frame 8] while drawing 2 carries out flow loading of LED1 outside Kon purple The phosphor layer 2 which formed BGRY fluorescent substance particles (3, 4, 5, 6) by resin inherent in the cup 9 is formed, and the semiconductor light emitting element of the structure which closed the whole by closure resin 10 is shown. Drawing 3 shows the chip type semiconductor light emitting element of the structure which formed the phosphor layer 2 which formed BGRY fluorescent substance particles (3, 4, 5, 6) by resin inherent in the case 11 while arranging LED1 outside Kon purple in a case 11.
In drawing 1 - drawing 3 , LED1 outside **** exceeds 350nm and And 410nm or less, It is LED which emits the near-ultraviolet light which exceeds 350nm preferably and has a luminescence peak to the wavelength field below 400nm. A gallium nitride system compound semiconductor, a carbonization silicon system compound semiconductor, a zinc selenide system compound semiconductor, It is the photoelectrical conversion element (what is called LED, a laser diode, a field luminescence laser diode, an inorganic electroluminescence (EL) element, organic EL device) which has the luminous layer constituted from inorganic compounds, such as a zinc sulfide system compound semiconductor, and an organic compound. It impresses [voltage-] or pours [current-] in LED1 outside **********, and the near-ultraviolet light which has a luminescence peak in said wavelength within the limits is obtained.
In order to obtain a big near-ultraviolet light output by being stabilized for a long period of time here, since luminescence intensity is large, LED1 outside **** has the more desirable outside LED of Kon [who has the luminous layer which the inorganic matter LED constituted from an inorganic compound was desirable, and constituted from a gallium nitride system compound semiconductor also in it] purple.
[the phosphor layer 2 absorbs the near-ultraviolet light which LED1 outside **** emits, and / luminescence ****** (x, y) in a CIE chromaticity diagram] It is for changing into $0.21<=x<=0.48$ and the white system light in the range of $0.19<=y<=0.45$. The blue system fluorescent substance particles 3 which emit the fluorescence of a blue system which absorbs the near-ultraviolet light which LED1 outside **** emits, and has a luminescence peak to the wavelength field below 400nm or more and 500nm, The green system fluorescent substance 4 emit the fluorescence of a green system which absorbs the near-ultraviolet light which LED1 outside **** emits, and has a luminescence peak to the wavelength field below 500nm or more and 550nm, The red system fluorescent substance 5 emit the fluorescence of a red system which absorbs the near-ultraviolet light which LED1 outside **** emits, and has a luminescence peak to the wavelength field below 600nm or more and 660nm, The yellow system fluorescent substance 6 emit the fluorescence of a yellow system which absorbs the near-ultraviolet light which LED1 outside **** emits, and has a luminescence peak to the wavelength field below 550nm or more and 600nm is included.

It is made to distribute in a base material and the phosphor layer 2 forms the aforementioned BGRY fluorescent substance particles (3, 4, 5, 6). As a base material, resin, such as an epoxy resin, an acrylic resin, polyimide resin, urea resin, and silicone resin, can be used, and an epoxy resin or silicone resin is desirable at a point with acquisition and handling inexpensive moreover about being easy. the real thickness of the phosphor layer 2 -- 10 micrometers or more -- and they are 100 micrometers or more and 700 micrometers or less preferably 1mm or less.
The blue system fluorescent substance particles 3 in the phosphor layer 2 absorb the near-ultraviolet light which LED1 outside **** emits. [that what is necessary is just the blue system fluorescent substance 3 from which the fluorescence of a blue system which has a luminescence peak is wavelength emitted below 400nm or more and 500nm, even if it is a charge of non-equipments and is an organic material (for example, fluorescence pigment), can use it, but] It is good to consider it as the fluorescent substance of either desirable following (1) or (2).
(1) The HARO orthophosphate fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M11-xEux)10(PO4)6Cl2
However, at least one alkaline-earth-metals element with which M1 is chosen from the group of Ba, Sr, and Ca and Mg, and x are numerical values with which it is satisfied of 0< x<1.
(2) The Al Min acid chloride fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M21-xEux)(M31-y1Mny1)Al10O17
However, at least one element with which at least one alkaline-earth-metals element with which M2 is chosen from the group of Ba, Sr, and Ca, and M3 are chosen from the group of Mg and Zn, x, and y1 are numerical values with which it is satisfied of 0< x<1 and 0 <=y1<0.05 respectively.
in addition, as an example of said desirable blue system fluorescent substance BaMgAl10O17:Eu2+, aluminum(Mg (Ba, Sr), Mn) 10O17:Eu2+, (Sr, Ca, Ba, Mg) 10(PO4) 6Cl2:Eu2+, Sr5(PO4) 3Cl:Eu2+, 5 (Sr, Ca, Ba) (PO4) 3Cl:Eu2+, BaMg2aluminum16O27:Eu2+, 5(Ba, Ca) (PO4) 3Cl:Eu2+, etc. can be mentioned.
The green system fluorescent substance particles 4 in the phosphor layer 2 absorb the near-ultraviolet light which LED1 outside **** emits. That what is necessary is just the green system fluorescent substance 4 from which the fluorescence of a green system which has a luminescence peak is wavelength emitted below 500nm or more and 550nm, even if it is a charge of non-equipments and is an organic material, it can be used, but it is good to consider it as the fluorescent substance of either desirable following (3) or (4).
(3) The Al Min acid chloride fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M21-xEux)(M31-y2Mny2)Al10O17
However, at least one element with which at least one alkaline-earth-metals element with which M2 is chosen from the group of Ba, Sr, and Ca, and M3 are chosen from the group of Mg and Zn, x, and y2 are numerical values with which it is satisfied of 0< x<1 and 0.05 <=y2<1 respectively.
(4) The silicate fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(M11-xEux)2SiO4
However, at least one alkaline-earth-metals element with which M1 is chosen from the group of Ba, Sr, and Ca and Mg, and x are numerical values with which it is satisfied of 0< x<1.
As an example of said desirable green system fluorescent substance (BaMg) aluminum16O27:Eu2+, Mn2 +, 2(BaMg) SiO4:Eu2+, Ba2SiO4:Eu2+, Sr2SiO4:Eu2+, SiO(BaSr) 4:Eu2+, SiO(Ba, Sr) 4:Eu2+, etc. can be mentioned.
The red system fluorescent substance particles 5 in the phosphor layer 2 absorb the near-ultraviolet light which LED1 outside **** emits. That what is necessary is just the red system fluorescent substance 5 from which the fluorescence of a red system which has a luminescence peak is wavelength emitted below 600nm or more and 660nm, even if it is a charge of non-equipments and is an organic material, it can be used, but it is good to consider it as the fluorescent substance of following (5) desirably.
(5) The acid sulfide fluorescent substance which makes a subject the compound expressed with the following chemical formula.
(Ln1-xEux)O2S
However, at least one rare earth element as which Ln is chosen from the group of Sc, Y, La, and Gd, and x are numerical values with which it is satisfied of 0< x<1.
As an example of said desirable red system fluorescent substance 5, Sc2O2S:Eu3+, Y2O2S:Eu3+, Ln2O2S:Eu3+, Ln2O2S:Eu3+, Sm3+, Gd2O2S:Eu3+, etc. can be mentioned.
The yellow system fluorescent substance particles 6 in the phosphor layer 2 absorb the near-ultraviolet light which LED1 outside **** emits. Although what is necessary is just the yellow system fluorescent substance from which the fluorescence of a yellow system which has a luminescence peak is wavelength

emitted below 550nm or more and 600nm It is good to consider it as the silicate fluorescent substance which makes a subject the compound expressed with the desirable following chemical formula triggered by the ease of manufacture, good [of luminescence performance] (high-intensity, high yellow purity), etc.
(Sr1-a1-b1-xBaa1Cab1Eux)2SiO4
however, the numerical value with which a1, b1, and x are satisfied of each, 0<=a1<=0.3, 0<=b1<=0.8, and 0< x<1 -- preferably respectively -- 0<a1<=0.2, 0<=b1<=0.7, and 0.005<=x<=0.1 -- it is each, 0<a1<=0.15, 0<=b1<=0.6, and 0.01<=x<=0.05 more preferably.
It is good to consider it as the silicate fluorescent substance which makes a subject the compound expressed with the following chemical formula much more preferably.
(Sr1-a1-b2-xBaa1Cab2Eux)2SiO4
However, a1, b2, and x are numerical values with which it is satisfied of 0<=a1<=0.3, 0<=b2<=0.6, and 0< x<1 respectively.
Although the aforementioned silicate fluorescent substance can take ****** and single **** as a crystal structure, in the semiconductor light emitting element of this invention, the crystal structures of a silicate fluorescent substance may be any of ****** and single ****, and can use following (a) or the silicate fluorescent substance of (b).
(a) The silicate fluorescent substance of the following composition which has the crystal structure of ******.
(Sr1-a1-b2-xBaa1Cab2Eux)2SiO4
however, a1, b2, and x -- each, 0<=a1<=0.3, 0<=b2<=0.6, and 0< x<1 -- preferably They are 0<a1<=0.2, 0<=b2<=0.4, 0.005<=x<=0.1, and the numerical value for which 0<a1<=0.15, 0<=b2<=0.3, and 0.01<=x<=0.05 are satisfied respectively more preferably respectively.
(b) The silicate fluorescent substance of the following composition which has the crystal structure of single ****.
(Sr1-a2-b1-xBaa2Cab1Eux)2SiO4
however, a2, b1, and x -- each, 0<=a2<=0.2, 0<=b1<=0.8, and 0< x<1 -- preferably They are 0<=a2<=0.15, 0<b1<=0.7, 0.005<=x<=0.1, and the numerical value for which 0<=a2<=0.1, 0<b1<=0.6, and 0.01<=x<=0.05 are satisfied respectively more preferably respectively.
In composition of the numerical value in which a1 in said each type, a2, b1, and b2 are smaller than said within the limits, the crystal structure of a silicate fluorescent substance becomes unstable easily, and the problem from which the luminescence characteristic changes with temperature of operation arises. On the other hand, by composition of a larger numerical value than said within the limits, since luminescence becomes that which is tinged with greenishness, and does not become a good yellow system fluorescent substance but serves as a green system fluorescent substance, even if it combines with the fluorescent substance of a reddish, green system, and blue system, it does not become the semiconductor light emitting element which emits the Takamitsu bunch and the white system light of high Ra. Moreover, the amount x of Eu addition of luminescence intensity is weak in composition of a numerical value smaller than said within the limits, and the problem of temperature quenching that luminescence intensity falls with the rise of ambient air temperature arises notably in composition of a large numerical value.
In addition, as for the yellow system fluorescent substance been and used for the semiconductor light emitting element of this invention, it is more desirable to use the silicate fluorescent substance which has the crystal structure of said ****** for the Reason the color purity of the yellow system light which a silicate fluorescent substance emits is excellent. Moreover, the crystal structure of a silicate fluorescent substance can be stabilized, or a part of Sr, Ba, and Ca can also be replaced by Mg or Zn in order to raise luminescence intensity.
[a fluorescent substance / the article-size-distribution evaluation by laser diffraction / dispersion type article-size-distribution measuring instrument (for example, LMS-30: Made by Seishin Enterprise) is sufficient for said silicate fluorescent substance, if main particle diameter is a thing (0.1 micrometers or more and 100 micrometers or less), but] For the Reasons of composite ease [a fluorescent substance], the ease of acquisition, the ease [a phosphor layer] of formation, etc., the main particle diameter of 1 micrometers or more and 20 micrometers or less is desirable, and 2 micrometers or more and 10 micrometers or less are more desirable. About article size distribution, if the particles over less than 0.01 micrometer and 1000 micrometers are not included, it is good, but it is the same Reason as main particle diameter, and the silicate fluorescent substance which has the distribution approximated to the normal distribution within the limits of 1 micrometers or more and 50 micrometers or less is desirable.
In addition, the aforementioned silicate fluorescent substance can be manufactured by the synthetic method of a description in said literature (J. Electrochemical Soc.Vol.115, No.11(1968) pp.1181-1184), for example.
The characteristic of said silicate fluorescent substance is explained still more concretely hereafter.
Drawing 4 is the figure showing the example of the excitation spectrum of said silicate fluorescent substance, and an emission spectrum. The example of the excitation spectrum of the conventional YAG

system fluorescent substance and the emission spectrum is also collectively shown in drawing 4 for comparison.
[a fluorescent substance / a YAG system fluorescent substance has an excitation peak in three places, 100nm - near 300nm, 300nm - near 370nm, and 370nm - near 550nm, and / the light of narrow wavelength within the limits of these each / absorb and] so that drawing 4 may show [the silicate fluorescent substance used for 550-580nm yellowish green - a yellow wavelength field in this invention to being the fluorescent substance emit the fluorescence of a yellow system which has a luminescence peak] It is the yellow system fluorescent substance from which it has an excitation peak near 250-300nm, the light of large wavelength within the limits of 100-500nm is absorbed, and the fluorescence of a yellow system which has a luminescence peak is wavelength emitted [550-600nm yellowish green - yellow - / of **]. Moreover, it also turns out that it is the efficient fluorescent substance which exceeds 350nm and easily endures a YAG system fluorescent substance under excitation of the near-ultraviolet light below 400nm.
Therefore, it comes to emit yellow system light with the strong phosphor layer 2 by including in the phosphor layer 2 by making said silicate fluorescent substance into the yellow system fluorescent substance particles 6.
In addition, if it is the silicate fluorescent substance of composition of aabove mentioned the 1, a2, b1, b2, and numerical value within the limits of x, excitation and an emission spectrum will become a thing similar to the spectrum of the silicate fluorescent substance illustrated to drawing 4 .
[The form 2 of operation]
The form of operation of the semiconductor luminescence equipment of this invention is hereafter explained using Drawings. Drawing 5 - drawing 7 are the figures showing the example of the semiconductor luminescence equipment concerning this invention.
Drawing 5 shows the stand type lighting installation which used the semiconductor light emitting element of this invention, drawing 6 shows the display device for image display which used the semiconductor light emitting element of this invention, and drawing 7 shows the display device for a number display which used the semiconductor light emitting element of this invention.
In drawing 5 or drawing 7 , the semiconductor light emitting element 12 is a semiconductor light emitting element of this invention explained with the form 1 of operation.
In drawing 5 , 13 is a switch for making the semiconductor light emitting element 12 turn on, and if it turns on a switch 13, the semiconductor light emitting element 12 will energize it, and it will come to emit luminescence.
In addition, yes [the semiconductor luminescence equipment whose lighting installation of drawing 5 is what was shown as a desirable example and which is applied to this invention is limited to this embodiment, and]. Moreover, the form in particular for the luminescence color of the semiconductor light emitting element 12, a size, a number, and a light-emitting part etc. is not limited.
Moreover, [color temperature / 2000K or more and below 12000K / 3000K or more and below 10000K] in the lighting installation of this example preferably although desirable color temperature is 3500K or more and 8000K or less still more preferably The lighting installation as semiconductor luminescence equipment concerning this invention is not limited to said color temperature.
Although image display equipment and a number display device were shown in drawing 6 and drawing 7 as an example of the display device as semiconductor luminescence equipment concerning this invention, the semiconductor luminescence equipment concerning this invention is not limited to these.
It is, if constituted like the case of said lighting installation using the semiconductor light emitting element 12 explained with the form 1 of operation, and the display device as an example of semiconductor luminescence equipment is **. Moreover, in particular the luminescence color of the semiconductor light emitting element 12, a size, a number, the form for a light-emitting part, the method of arrangement of a semiconductor light emitting element, etc. are not limited, and appearance form in particular is not limited, either.
The size as image display equipment can be arbitrarily manufactured 1cm or more in width and 10m or less, 1cm or more in height and 10m or less, the depth of 5mm or more, and in 5m or less, and can set up the number of a semiconductor light emitting element according to this size.
In the number display device shown in drawing 6 , it is the semiconductor light emitting element which 12 explained with the form 1 of operation. In this number display device, the form of the luminescence color of the semiconductor light emitting element 12, a size, a number, and a pixel etc. is not limited like the case of image display equipment. Moreover, a printable character may not be limited to a number and may be a Chinese character, katakana, the alphabet, the Greek alphabet, etc.
In addition, if it is in semiconductor luminescence equipment as shown in drawing 5 - drawing 7 If it is made the luminescence equipment constituted using two or more semiconductor light emitting elements 12 which used only one kind of LED chip, while operation of each semiconductor light emitting element in the completely same drive voltage and the completely same inrush current will be attained While

coming to be also able to make almost the same characteristic change of the light emitting element by external factors, such as ambient air temperature, and being able to lessen the luminescence intensity of a light emitting element and the rate of change of a color tone to voltage change or a temperature change, circuit composition of luminescence equipment can be made simple.

Moreover, if a pixel side constitutes semiconductor luminescence equipment using a flat semiconductor light emitting element, flat luminescence equipment of a luminescence side, such as a display device with a flat display surface and a lighting installation which carries out field luminescence, can be offered, and the image display equipment which has good quality of image, and the lighting installation which is excellent in design nature can be offered.

The semiconductor luminescence equipment concerning this invention turns into luminescence equipment of the Takamitsu bunch by constituting luminescence equipment using the semiconductor light emitting element which was indicated in the form 1 of operation and from which the white system light of the Takamitsu bunch is obtained.

In addition, the semiconductor luminescence equipment not only concerning the luminescence equipment constituted using the semiconductor light emitting element of a description in the form 1 of operation but this invention may be semiconductor luminescence equipment which combines the light emitting element outside said Kon purple, and said phosphor layer. Even if it does in this way, it cannot be overemphasized that the same operation effect is acquired and the same semiconductor luminescence equipment is obtained.

(Work example 1)

It is a blue system fluorescent substance aluminum(M(M21-xEux)31-y1Mny1) 10O17 (however, [M2]) [at least one alkaline-earth-metals element chosen from the group of Ba, Sr, and Ca, and M3] [at least one element chosen from the group of Mg and Zn, x, and y1] It is the numerical value with which it is satisfied of 0< x<1 and 0 <=y1<0.05 respectively. Are expressed with a chemical formula. (Ba, Sr) MgAl10O17:Eu2+ and a Mn2+ Al Min acid chloride blue fluorescent substance (M2=0.9Ba+ -- 0.1 Sr) It is referred to as x= 0.1 and y= 0.015, and is a green system fluorescent substance aluminum(M(M21-xEux)31-y2Mny2) 10O17 (however, [M2]) [at least one alkaline-earth-metals element chosen from the group of Ba, Sr, and Ca, and M3] [at least one element chosen from the group of Mg and Zn, x, and y2] It is the numerical value with which it is satisfied of 0< x<1 and 0.05 <=y2<1 respectively. Are expressed with a chemical formula. considering it as BaMgAl10O17:Eu2+ and a Mn2+ Al Min acid chloride green fluorescent substance (x= 0.1, y= 0.3) -- a red system fluorescent substance -- O(Ln1-xEux) 2S (however, at least one rare earth element as which Ln is chosen from the group of Sc, Y, La, and Gd --) x is a numerical value with which it is satisfied of 0< x<1. It is considered as the LaO2 S:Eu3+ acid sulfide red fluorescent substance (x= 0.1) expressed with a chemical formula. It is a yellow system fluorescent substance 2(Sr1-a1-b1-xBaa1Cab1Eux) SiO4 (however, [a1, b1, and x]) It is the numerical value with which it is satisfied of 0<=a1<=0.3, 0<=b1<=0.8, and 0< x<1 respectively. The semiconductor light emitting element which is expressed with a chemical formula and has the crystal structure of ****** and which was used as the 2(Sr, Ba) SiO4:Eu2+ silicate yellow fluorescent substance (a1=0.1, b1=0, x= 0.02) was manufactured.

The structure of the semiconductor light emitting element was used as the semiconductor light emitting element of the structure which prepared the phosphor layer formed in the cup by the epoxy resin in which BGRY fluorescent substance particles are inherent while it carried out flow loading of the outside LED of **** at the cup prepared in the mount lead as shown in drawing 2 . Moreover, **** outside LED was carried out the outside LED of Kon purple of an InGaN system which has the luminous layer constituted from a gallium nitride system compound semiconductor, and has a luminescence peak in wavelength of 380nm. The emission spectrum of the fluorescent substance of a blue fluorescent substance [under near-ultraviolet light excitation with a wavelength / from the outside LED of this **** / of 380nm], green fluorescent substance, and red fluorescent substance and a silicate yellow fluorescent substance was shown in (a) of drawing 15 , (d), (f), and (g).

The weight rate of 55:14:42:24, an epoxy resin, and these fluorescent substances (mixed fluorescent substance) was set to 20:80 for the mixed weight rate of the said blue fluorescent substance, green fluorescent substance, and red fluorescent substance and the silicate yellow fluorescent substance, the real thickness of the phosphor layer was about 600 micrometers, and the semiconductor light emitting element was constituted.

The semiconductor light emitting element (comparative example 1) which does not contain a yellow system fluorescent substance including the same blue system fluorescent substance as a work example 1, a green system fluorescent substance, and a red system fluorescent substance in a phosphor layer for comparison was manufactured. In the semiconductor light emitting element of this comparative example 1, the mixed weight rate of the blue fluorescent substance, green fluorescent substance, and red fluorescent substance was set to 29:26:52, in addition it was made the same as the semiconductor light emitting element of a work example 1 about the weight rate of an epoxy resin and a mixed fluorescent substance, and the real thickness of the phosphor layer.

10mA was energized out of [of the semiconductor light emitting element of the aforementioned work example 1 and a comparative example 1 / LED] Kon purple, the outside LED of **** was operated, and white system light was obtained from the semiconductor light emitting element. The color temperature of this white system light, Duv, the value in a CIE chromaticity diagram (x, y), Ra, and the relative value of light flux were evaluated using the multi-light measurement system (MCPD-7000: made by Otsuka electronic incorporated company) at the moment. This result is shown in Table 1. Moreover, the emission spectrum of white system light which the semiconductor light emitting element of a work example 1 and a comparative example 1 emits is shown in drawing 8 and drawing 9 . As shown in Table 1, the almost same color temperature (7880-9500K), the white system of Duv (-15.6 - -8.7) and the degree of color (x= 0.290-0.301, y= 0.278-0.293) -- under light, light flux (about 125%) with the higher semiconductor light emitting element of the work example 1 concerning this invention and high Ra (68) were obtained.
[Table 1]

	色温度 (K)	Duv	x	y	Ra	光束の相対値
実施例1	8540	-12.3	0.297	0.284	68	1803
比較例1	9500	-11.3	0.290	0.278	31	1470

(Work example 2)
It is a green system fluorescent substance 2(M11-xEux) SiO4 (however, [M1]) Ba, Sr, at least one alkaline-earth-metals element chosen from the group of Ca and Mg, x is a numerical value with which it is satisfied of 0< x<1. It carries out by considering it as the 2SiO4:Eu2+ silicate green fluorescent substance (M1=0.4Ba+0.6Sr, x= 0.02) expressed with a chemical formula (Ba, Sr). The mixed weight rate of the blue fluorescent substance, green fluorescent substance, and red fluorescent substance and the silicate yellow fluorescent substance was set to 92:3:33:48, and also the semiconductor light emitting element (work example 2) was manufactured on the same conditions as a work example 1. The emission spectrum of the aforementioned (Ba, Sr) 2SiO17:Eu2+ silicate green fluorescent substance under near-ultraviolet light excitation with a wavelength of 380nm was shown in (e) of drawing 15 .
For comparison, the semiconductor light emitting element (comparative example 2) which does not contain a yellow system fluorescent substance in a phosphor layer was also manufactured with the same green system fluorescent substance as a work example 2. The mixed weight rate of the blue fluorescent substance [in the semiconductor light emitting element of a comparative example 2], green fluorescent substance, and red fluorescent substance was set to 50:29:64.
The color temperature of the white system light obtained by operation besides [LED] Kon purple of the aforementioned semiconductor light emitting element, Duv, the value in a CIE chromaticity diagram (x, y), Ra, and the relative value of light flux were evaluated like the work example 1. A result is shown in Table 2. Moreover, the emission spectrum of white system light which the semiconductor light emitting element of a work example 2 and a comparative example 2 emits is shown in drawing 10 and drawing 11 . As shown in Table 2, the almost same color temperature (7880-9500K), the white system of Duv (-15.6 - -8.7) and the degree of color (x= 0.290-0.301, y= 0.278-0.293) -- under light, light flux (about 113%) with the higher semiconductor light emitting element of the work example 2 concerning this invention and high Ra (86) were obtained. Moreover, even if compared with the semiconductor light emitting element of the work example 1, high light flux and high Ra were obtained.
[Table 2]

	色温度 (K)	Duv	x	y	Ra	光束の相対値
実施例2	8360	-15.6	0.300	0.282	86	2040
比較例2	8630	-8.7	0.294	0.288	66	1810

(Work example 3)
It is a blue system fluorescent substance aluminum(M(M21-xEux)31-y1Mny1) 10O17 (however, [M2]) [at least one alkaline-earth-metals element chosen from the group of Ba, Sr, and Ca, and M3] [at least one element chosen from the group of Mg and Zn, x, and y1] It is the numerical value with which it is

satisfied of 0< x<1 and 0 <=y1<0.05 respectively. Are expressed with a chemical formula. It is considered as a BaMgAl10O17:Eu2+ Al Min acid chloride blue fluorescent substance (x= 0.1, y= 0: the two Al Min acid chloride blue fluorescent substances). The mixed weight rate of the green fluorescent substance and red fluorescent substance and the yellow fluorescent substance was set to 112:12:20:77, and also the semiconductor light emitting element (work example 3) was manufactured on the same conditions as a work example 1. The emission spectrum of said BaMgAl10O17:Eu2+ Al Min acid chloride blue fluorescent substance under near-ultraviolet light excitation with a wavelength of 380nm was shown in (b) of drawing 15 .

The color temperature of the white system light which the above mentioned semiconductor light emitting element emits like work examples 1 and 2, Duv, the value in a CIE chromaticity diagram (x, y), Ra, and the relative value of light flux were evaluated. A result is shown in Table 3. Moreover, the emission spectrum of white system light which the semiconductor light emitting element of a work example 3 emits is shown in drawing 12 . As shown in Table 3, under the white system light of the almost same color temperature, Duv, and the degree of color, as for the semiconductor light emitting element of the work example 3 concerning this invention, high light flux (about 123%) and high Ra (92) were obtained as compared with the work example 1.

[Table 3]

	色温度 (K)	Duv	x	y	Ra	光束の相対値
実施例3	7880	-9.7	0.301	0.293	92	2259

(Work example 4)

It is a blue system fluorescent substance 10(M11-xEux) (PO4) 6Cl2 (however, [M1]) [Ba, Sr, at least one alkaline-earth-metals element chosen from the group of Ca and Mg, and x] It is the numerical value with which it is satisfied of 0< x<1. It was considered as the 10(PO4) 6Cl2:Eu2+ HARO orthophosphate blue fluorescent substance (M1=0.75Sr+0.25Ba, x= 0.01) expressed with a chemical formula (Sr, Ba), and also the semiconductor light emitting element (work example 4) was manufactured on the same conditions as a work example 1. The emission spectrum of the aforementioned (Sr, Ba) 10(PO4) 6Cl2:Eu2 + HARO orthophosphate blue fluorescent substance under near-ultraviolet light excitation with a wavelength of 380nm was shown in (c) of drawing 15 .

The color temperature of the white system light which the semiconductor light emitting element of a work example 4 emits, Duv, the degree of color, Ra, and the relative value of light flux were evaluated. As for the result, it is as being shown in Table 4, and the almost same white system light as the semiconductor light emitting element of a work example 1 was obtained.

[Table 4]

	色温度 (K)	Duv	x	y	Ra	光束の相対値
実施例4	8480	-12.2	0.297	0.284	66	1820

(Work example 5)

The result of having carried out simulation evaluation of the luminescence characteristic of the semiconductor light emitting element concerning this invention using the computer is explained. As digital data for simulation evaluation, under near-ultraviolet light excitation with a wavelength of 380nm The emission-spectrum data (measurement wavelength range: 390-780nm, wavelength unit:5nm) of the fluorescent substance of following the (1) - (4) surveyed using the multi-light measurement system (MCPD-7000: made by Otsuka electronic incorporated company) at the moment was used.

(1) BaMgAl10O17:Eu2+ Al Min acid chloride blue fluorescent substance (refer to work example 3).

(2) (Ba, Sr) MgAl10O17:Eu2+, Mn2+ Al Min acid chloride green fluorescent substance (refer to work example 1).

(3) LaO2 S:Eu3+ acid sulfide red fluorescent substance (refer to work example 1).

(4) The 2SiO4:Eu2+ silicate yellow fluorescent substance which has the crystal structure of ****** (Sr, Ba) (refer to work example 1).

So that the illumination rate by the yellow system light which said silicate yellow fluorescent substance in white system light emits may be made into a parameter and color temperature 8000K and the white system light of Duv=0 may be obtained The relative value of the light flux of white system light was

computed by having optimized the emission-spectrum intensity ratio of blue light, green light, red light, and yellow light which each fluorescent substance of said Al Min acid chloride blue fluorescent substance, the Al Min acid chloride green fluorescent substance, an acid sulfide red fluorescent substance, and a silicate yellow fluorescent substance releases by computer. A result is shown in Table 5.
[Table 5]

（Ｓｒ，Ｂａ）$_2$ＳｉＯ$_4$Ｅｕ$^{2+}$珪酸塩黄色蛍光体による照度割合	白色系光（色温度８０００Ｋ、Ｄｕｖ＝０）の光束の相対値
０％（黄色蛍光体なし）	１００
１０％	１０３
２０％	１０７
３０％	１１１
４０％	１１５
５０％	１１９
６０％	１２４
７０％	１２９
８０％	１３４

Table 5 A BaMgAl10O17:Eu2+ Al Min acid chloride blue fluorescent substance, (Ba, Sr) by adding a 2 (Sr, Ba) SiO4:Eu2+ silicate yellow fluorescent substance to MgAl10O17:Eu2+, a Mn2+ Al Min acid chloride green fluorescent substance, and a LaO2 S:Eu3+ acid sulfide red fluorescent substance It is shown that the Takamitsu bunch-ization of white system light is realizable and that its light flux improves as a certain addition rate increases the mixed rate of a silicate yellow fluorescent substance. Moreover, the experimental result of the work examples 1, 3, and 4 which acquired the Takamitsu bunch from the semiconductor light emitting element is also theoretically supported by adding a silicate yellow fluorescent substance to the phosphor layer which mixes a blue system fluorescent substance, a green system fluorescent substance, and a red system fluorescent substance further.
The example of the emission spectrum of said white system light (color temperature 8000K, Duv=0) which carried out the simulation is shown in drawing 13 (a) and (b). As for drawing 13 (b), drawing 13 (a) shows the case where this illumination percentage is 0%, when the illumination percentage by a 2(Sr, Ba) SiO4:Eu2+ silicate yellow fluorescent substance is 50%.
(Work example 6)
The result of having performed the simulation evaluation same about the fluorescent substance of following the (1) - (4) as a work example 5 is shown in Table 6.
(1) BaMgAl10O17:Eu2+ Al Min acid chloride blue fluorescent substance (refer to work example 3).
(2) (Ba, Sr) 2SiO17:Eu2+ silicate green fluorescent substance (refer to work example 2).
(3) LaO2 S:Eu3+ acid sulfide red fluorescent substance (refer to work example 1).
(4) The 2SiO4:Eu2+ silicate yellow fluorescent substance which has the crystal structure of ****** (Sr, Ba) (refer to work example 1).
Like the case of a work example 5, the illumination rate by the yellow system light which the silicate yellow fluorescent substance in white system light emits was made into the parameter, and the relative value of the light flux of the white system light obtained was computed. In addition, the relative value when setting to 100 the case where the illumination percentage by the 2SiO4:Eu2+ silicate yellow fluorescent substance in a work example 5 (Sr, Ba) is 0% shows the relative value of the light flux of white system light shown in Table 6.
[Table 6]

（Ｓｒ，Ｂａ）$_2$ＳｉＯ$_4$：Ｅｕ$^{2+}$ 珪酸塩黄色蛍光体による照度割合	白色系光（色温度８０００Ｋ、Ｄｕｖ＝０）の光束の相対値
０％（黄色蛍光体なし）	１２０
１０％	１２２
２０％	１２４
３０％	１２６
４０％	１２９
５０％	１３１
６０％	１３４
７０％	１３６

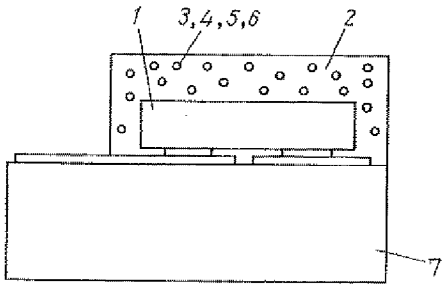
Table 6 like the case of a work example 5 A BaMgAl10O17:Eu2+ Al Min acid chloride blue fluorescent substance, (Ba, Sr) by adding a 2(Sr, Ba) SiO4:Eu2+ silicate yellow fluorescent substance to a 2SiO17: Eu2+ silicate green fluorescent substance and a LaO2 S:Eu3+ acid sulfide red fluorescent substance It is shown that the Takamitsu bunch-ization of white system light is realizable and that its light flux improves as a certain addition rate increases the mixed rate of a silicate yellow fluorescent substance. Moreover, the experimental result of the work example 2 which acquired the Takamitsu bunch from the semiconductor light emitting element is also theoretically supported by adding a silicate yellow fluorescent substance to the phosphor layer which mixes a blue system fluorescent substance, a green system fluorescent substance, and a red system fluorescent substance further.
The example of the emission spectrum of said white system light (color temperature 8000K, Duv=0) which carried out the simulation is shown in drawing 14 (a) and (b). As for drawing 14 (b), drawing 14 (a) shows the case where this illumination percentage is 0%, when the illumination percentage by a 2(Sr, Ba) SiO4:Eu2+ silicate yellow fluorescent substance is 50%.
As mentioned above, simulation evaluation has also proved that the semiconductor light emitting element concerning this invention was a semiconductor light emitting element which emits the white system light of the Takamitsu bunch rather than the conventional semiconductor light emitting element.
Possibility of industrial use
The semiconductor light emitting element of this invention absorbs the near-ultraviolet light near [which the outside LED of this **** releases the outside LED of ****] 350-410nm. It is in the semiconductor light emitting element which combines the phosphor layer containing two or more fluorescent substances from which the fluorescence which has a luminescence peak is visible wavelength emitted [of 380nm or more and 780nm or less]. By using said phosphor layer as the phosphor layer containing four kinds of fluorescent substances, a blue system fluorescent substance, a green system fluorescent substance, a red system fluorescent substance, and a yellow system fluorescent substance While compensating a part for the light flux fall by red system luminescence with low spectral luminous efficacy with comparatively high yellow system luminescence of spectral luminous efficacy, it becomes that the white system light obtained excelled [that] in the field of color balance, and the semiconductor light emitting element which emits the Takamitsu bunch and the white system light of high Ra can be obtained. By using a silicate fluorescent substance as a yellow system fluorescent substance especially, it becomes the efficient semiconductor light emitting element which easily endures the conventional semiconductor light emitting element using a YAG system fluorescent substance.
moreover, the semiconductor luminescence equipment of this invention -- the outside LED of ****, and a blue system -- a fluorescent substance and a green system -- having composition which combines the phosphor layer containing four kinds of fluorescent substances of a fluorescent substance, a red system fluorescent substance, and a yellow system fluorescent substance -- the Takamitsu bunch and the white system of high Ra -- the semiconductor luminescence equipment emit light can be offered.
[Brief Description of the Drawings]
Drawing 1 is the longitudinal section of the semiconductor light emitting element of this invention.
Drawing 2 is the longitudinal section of the semiconductor light emitting element of this invention.
Drawing 3 is the longitudinal section of the semiconductor light emitting element of this invention.

Drawing 4 is the figure showing luminescence and the excitation spectrum of a silicate fluorescent substance and a YAG system fluorescent substance.
Drawing 5 is the figure showing the lighting installation as an example of the semiconductor luminescence equipment of this invention.
Drawing 6 is the figure showing the image display equipment as an example of the semiconductor luminescence equipment of this invention.
Drawing 7 is the figure showing the number display device as an example of the semiconductor luminescence equipment of this invention.
Drawing 8 is the figure showing the emission spectrum of the semiconductor light emitting element of a work example 1.
Drawing 9 is the figure showing the emission spectrum of the semiconductor light emitting element of a comparative example 1.
Drawing 10 is the figure showing the emission spectrum of the semiconductor light emitting element of a work example 2.
Drawing 11 is the figure showing the emission spectrum of the semiconductor light emitting element of a comparative example 2.
Drawing 12 is the figure showing the emission spectrum of the semiconductor light emitting element of a work example 3.
Drawing 13 is the figure showing the emission spectrum of the white system light by a simulation.
Drawing 14 is the figure showing the emission spectrum of the white system light by a simulation.
Drawing 15 is the figure showing the emission spectrum of the fluorescent substance used by this invention.

[Brief Description of the Drawings]
Drawing 1 is the longitudinal section of the semiconductor light emitting element of this invention.
Drawing 2 is the longitudinal section of the semiconductor light emitting element of this invention.
Drawing 3 is the longitudinal section of the semiconductor light emitting element of this invention.
Drawing 4 is the figure showing luminescence and the excitation spectrum of a silicate fluorescent substance and a YAG system fluorescent substance.
Drawing 5 is the figure showing the lighting installation as an example of the semiconductor luminescence equipment of this invention.
Drawing 6 is the figure showing the image display equipment as an example of the semiconductor luminescence equipment of this invention.
Drawing 7 is the figure showing the number display device as an example of the semiconductor luminescence equipment of this invention.
Drawing 8 is the figure showing the emission spectrum of the semiconductor light emitting element of a work example 1.
Drawing 9 is the figure showing the emission spectrum of the semiconductor light emitting element of a comparative example 1.
Drawing 10 is the figure showing the emission spectrum of the semiconductor light emitting element of a work example 2.
Drawing 11 is the figure showing the emission spectrum of the semiconductor light emitting element of a comparative example 2.
Drawing 12 is the figure showing the emission spectrum of the semiconductor light emitting element of a work example 3.
Drawing 13 is the figure showing the emission spectrum of the white system light by a simulation.
Drawing 14 is the figure showing the emission spectrum of the white system light by a simulation.
Drawing 15 is the figure showing the emission spectrum of the fluorescent substance used by this invention.

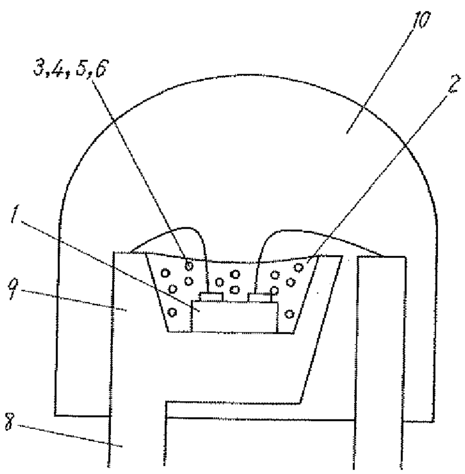
[Drawing 1]

FIG. 1



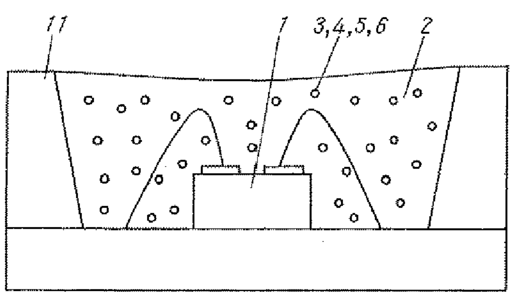
[Drawing 2]

FIG. 2



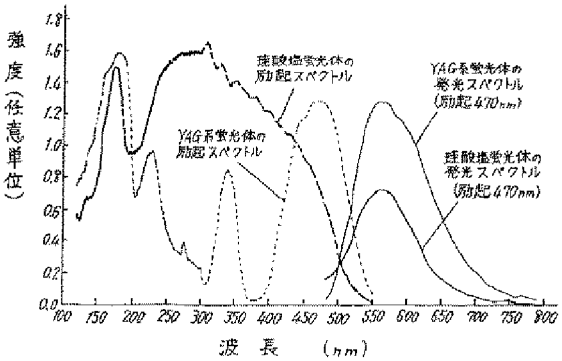
[Drawing 3]

FIG. 3



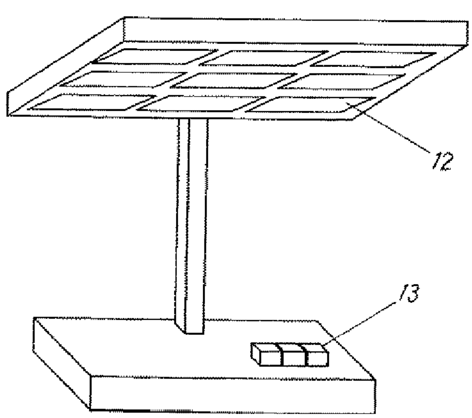
[Drawing 4]

FIG. 4



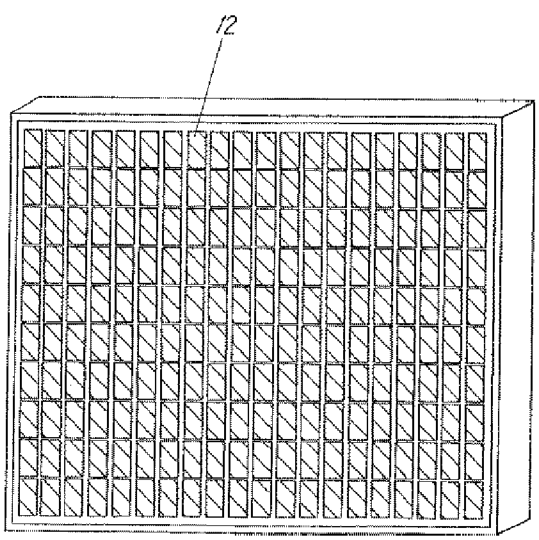
[Drawing 5]

FIG. 5



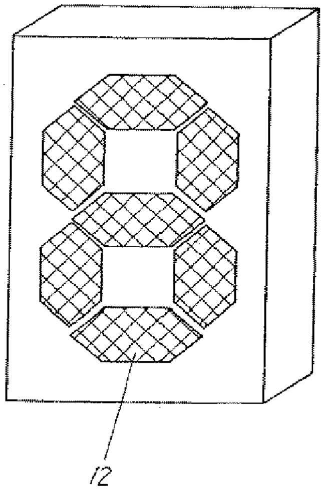
[Drawing 6]

FIG. 6



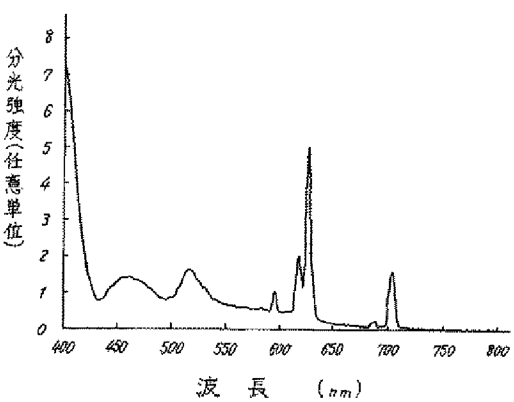
[Drawing 7]

FIG. 7



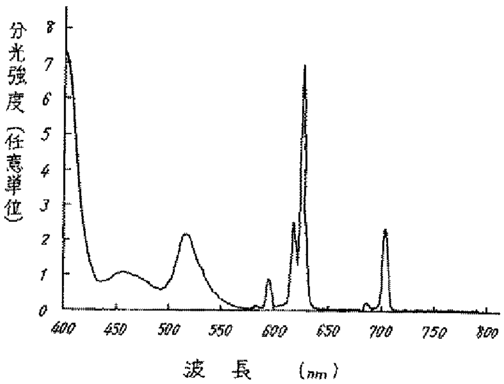
[Drawing 8]

FIG. 8



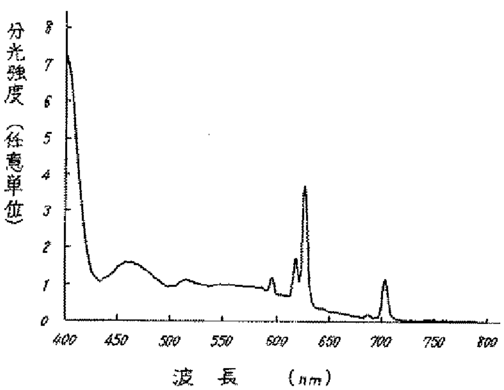
[Drawing 9]

FIG. 9



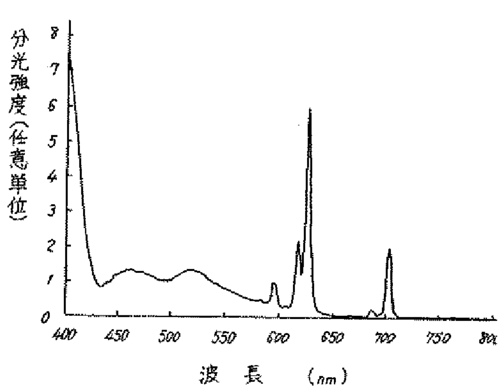
[Drawing 10]

FIG. 10



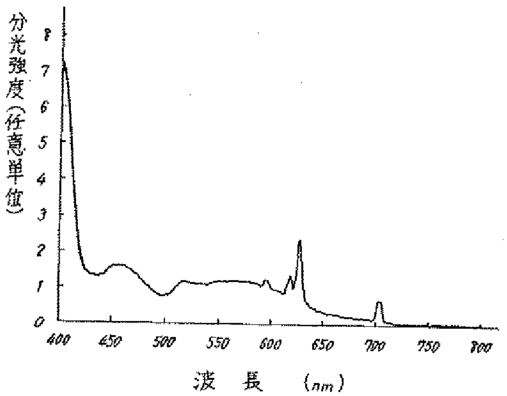
[Drawing 11]

FIG. 11



[Drawing 12]

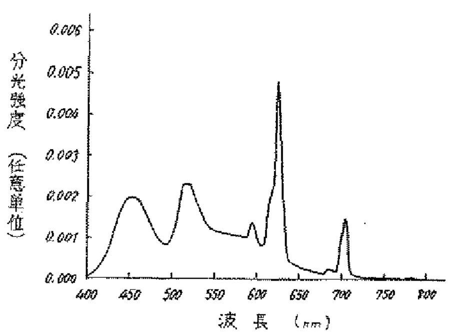
FIG. 12



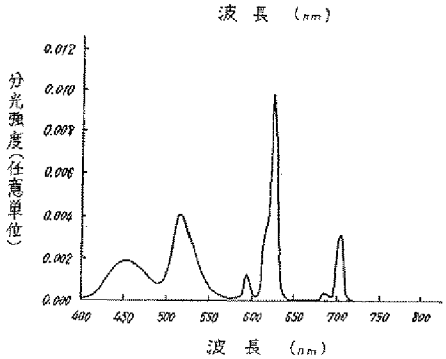
[Drawing 13]

FIG. 13

(a)

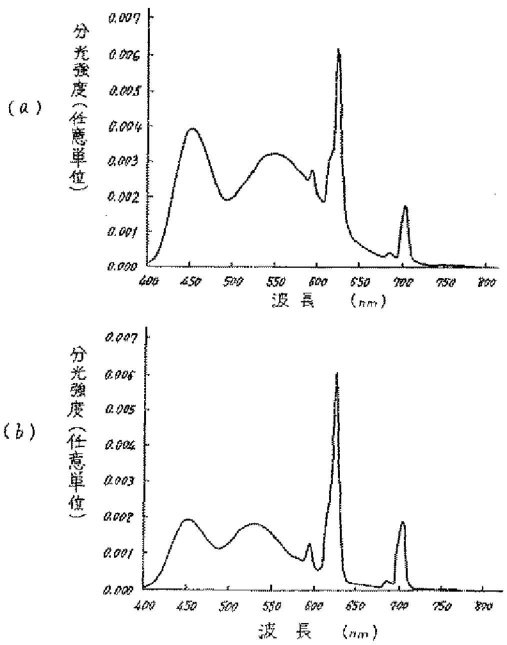


(b)



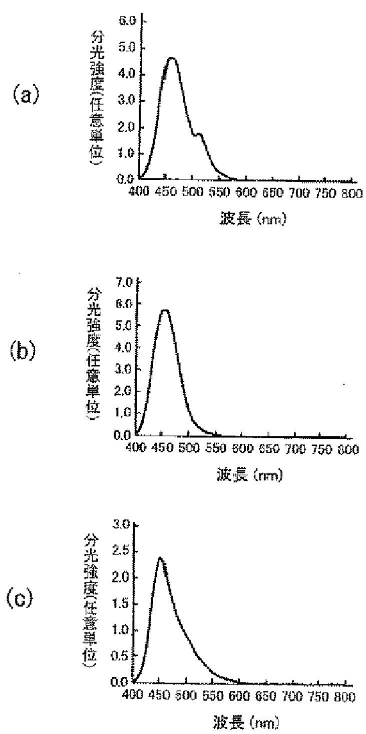
[Drawing 14]

FIG. 14



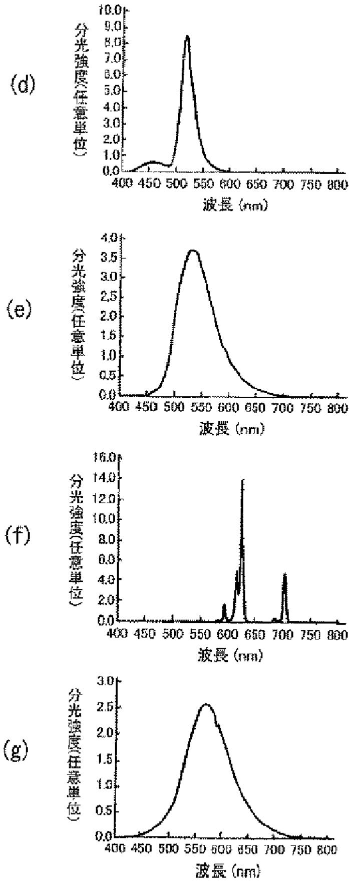
[Drawing 15]

FIG. 15



[Drawing 15]

FIG. 15



[Translation done.]